Yearly Mean (Average) Sunspot Numbers……Mr. Mathras…Space Science

Make no marks on these papers.
(Grouping: two or three teams of approx. 8 persons each)

- **Read the "Introduction" to Activity 2: Yearly Mean (Average) Sunspot Numbers**

Procedure:

1. Each person in each team will construct one graph by holding the paper in landscape mode (with punched holes at the top). Starting at the lower, left corner, count up 4 lines and from here count five lines to the right. Mark this intersection (the origination point) with a large dot. Darken in the Y-axis from the origination point to the top of the graph paper and the X-axis from the origination point to the right edge of the graph paper.
2. Labeling the origination point as zero, each line going up the Y-axis will have a value of 10, but you will **only label those lines that are evenly divisible by 50**. Continue this pattern to a maximum of 200 and label the Y-axis "SUNSPOT NUMBERS."
3. The X-axis will used to display the date according to the distribution listed below (ex. One graph will only contain data for the years 1700 through 1737, a second graph will only contain data for the years 1738 through 1775, etc.). The origination point will be labeled with the starting date for your graph, but then **only those dates evenly divisible by 10 will be labeled**…up until the very last date for your graph, which will be labeled with the ending date for that particular graph.. Label the X-axis "DATE."

(**NOTE: BY following the instructions for # 1-3 above carefully, each team will be able to tape/staple all 8 individual graphs into one continuous display.**

Starting date	Ending Date
1700	1737
1738	1775
1776	1813
1814	1850
1851	1888
1889	1926
1927	1964
1965	1995

4. Using the data from the attached "Sunspot Charts #1 & 2," each person will plot the average number of sunspots for the dates on his/her assigned graph. Because this is a plot of sunspot values over time, lines will connect the dots. Enter the person's name responsible for the construction of the graph at the top of the graph below the center punched hole.
5. Staple or tape all graphs in the proper sequence to form a continuous data plot of sunspot numbers from the years 1700 through 1995.

Follow-up/Analysis:

1. As you can observe from your continuous graph, there does appear to be a cyclical, repeating pattern in the number of sunspots appearing over a period of time. What is the average time between periods of maximum sunspot activity? **Show your work.**

2. After observers plotted sunspot data for the first half of the 18th century, they were convinced that the cyclical pattern would continue. They numbered the one beginning with the minimum around 1755 and peaking in 1761 **"Cycle #1."** **Cycle #2** peaked in 1769. Label these two sunspot cycles accordingly at their peak years on your graph, and then continue to number each cycle through the year 1995. What sunspot cycle number are we **currently** experiencing?
3. Predict the year for the next sunspot maximum after 1995.
4. In what year will cycle #24 peak?
5. Between which two consecutive years (on your entire graph) was there the greatest **increase** in sunspot activity? (This is not the maximum you're looking for, but the greatest increase!)
6. Which two consecutive years showed the second greatest **increase** in sunspot activity?
7. Which two consecutive years showed the third greatest **increase** in sunspot activity?
8. What is the number of the solar cycle whose peak was represented by a plateau (difference of one or less than one average sunspot from one year to the next) of about three years?
9. Which sunspot cycle's peak exhibited the widest plateau (of about 4 years) but was slightly more varied from year to year than your answer to # 8 above?
10. Which was the only cycle to date that demonstrated a double peak?
11. Are irregularities in cycle patterns more likely to occur on the **upswing** (as one approaches sunspot maximum) or on the **down-side** (as one passes sunspot maximum and approaches sunspot minimum)? Cite specific examples on your team graph to support your answer.
12. Why is it important to collect and analyze data over long periods of time before drawing conclusions?
13. Compare the numerical value of sunspot maxima in the most recent half-century to those in the early 1700's.
14. What effects might this phenomenon (answer to # 11) have upon life on Earth?

Excellent websites which provides current data on sunspot activity and solar cycling:

http://www.sunspotcycle.com/

http://spacescience.com/headlines/y2000/ast22dec_1.htm

http://www.science.nasa.gov/newhome/headlines/ast02jun99_1.htm

http://science.msfc.nasa.gov/ssl/pad/solar/flares.htm